PageWriter 100
HP M1772A Cardiograph

User's Guide

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Before using the instrument, read this guide and become thoroughly familiar with the contents.

Responsibility of the Manufacturer

Hewlett-Packard only considers itself responsible for any effects on safety, reliability and performance of the equipment if:

assembly operations, extensions, re-adjustments, modifications or repairs are done by persons authorized by Hewlett-Packard, and

the electrical installation of the relevant room complies with the IEC or national requirements, and

the instrument is used according to the instructions for use presented in this manual.

Warning

As with all electronic equipment, radio frequency interference between this cardiograph and any existing RF transmitting or receiving equipment at the installation site, including electrosurgical equipment, should be evaluated carefully and any limitations noted before the equipment is placed in service. Monitoring during electrosurgery should not be attempted and monitoring electrodes should be removed from the patient to preclude the possiblity of burns. Radio frequency generation from electrosurgical equipment and close proximity transmitters may seriously degrade cardiograph performance. Hewlett-Packard assumes no liability for failures resulting from RF interference between HP medical electronics and any radio frequency generating equipment at levels exceeding those established by applicable standards.

This is to certify that this equipment is in accordance with the Radio Interference Requirements of the EMC Directive.

Warning

Use of accessories other than those recommended by Hewlett-Packard may compromise product performance and/or product safety.

THIS PRODUCT IS NOT INTENDED FOR HOME USE.

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Printing History

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April 1995	Edition 2
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Safety Summary

Safety Symbols Marked on the Cardiograph

The following safety symbols are used on the cardiograph.

Caution – See operating instructions.

Meets IEC type CF leakage current requirements and is defibrillator protected (Isolated ECG input).

Alternating current.

Equipotential (identifies independent protective earth conductor to the cardiograph).

Fuse.

Indicates power control for cardiograph.

Hz Indicates operating frequency in cycles per second.

Please see "Patient and Operational Safety Notes" in Chapter 1, **Getting Acquainted**, for further information about operating your cardiograph safely.

Conventions Used in This Manual

Warning

Warning statements describe conditions or actions that can result in personal injury or loss of life.

Caution

Caution statements describe conditions or actions that can result in damage to the equipment or software.

Note

Notes contain additional information on cardiograph usage.

(key) Represents keys on the front panel.

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Getting Acquainted

1

Getting Acquainted

This chapter describes to the new user the many features of the PageWriter 100 cardiograph, patient and operational safety, and AC/battery operation. The user should become familiar with this material, especially the safety information, prior to using the cardiograph.

Note

See Appendix A, **Setting up Your Cardiograph for the First Time** for information on checking the voltage switch setting, installing the battery, connecting the cables, and loading paper. Each of these tasks **must** be done prior to operating the cardiograph for the first time.

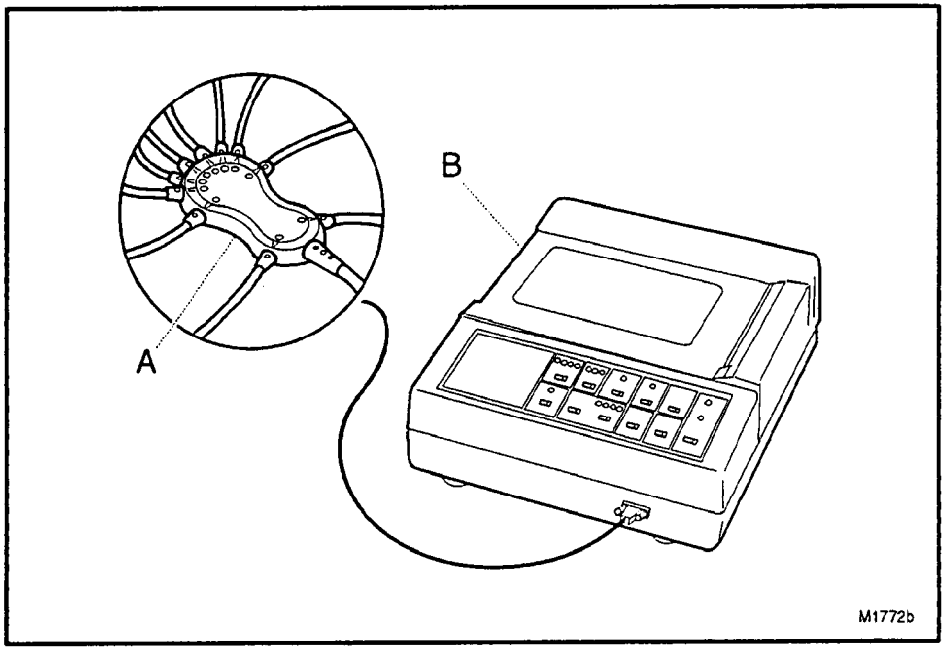


Figure 1-1. The PageWriter 100 Cardiograph.

A. Patient Cable
B. Cardiograph

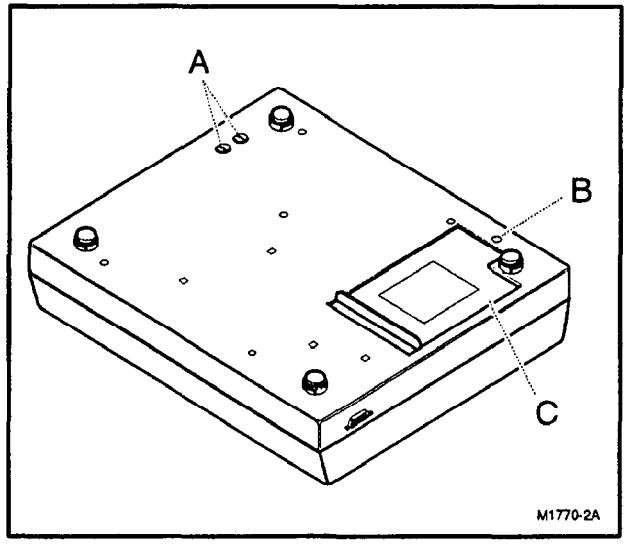


Figure 1-2. Bottom View of Cardiograph

A. AC Fuse Holders
B. Mounting Point for M1705B Cart
(Mounting screw included with cart)
C. Battery Door

The Keyboard and Front Panel

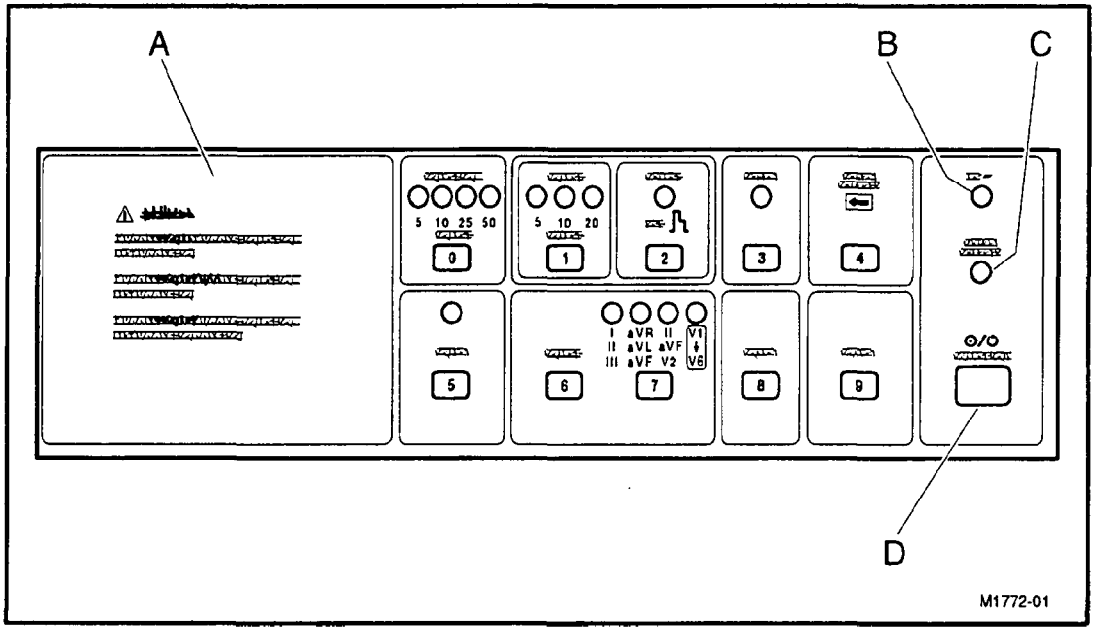


Figure 1-3. The Keyboard and Front Panel of the Cardiograph.

A	**Instructions**	This text describes how the front-panel lights indicate the operating status of the cardiograph:
	Attention:	A flashing **Auto** light indicates that the ECG is being acquired. When the light stays on, the acquisition is complete. A flashing **Chart Speed** light indicates a paper supply problem. A flashing **Manual** lead group light indicates an electrode connection problem.
B	**AC**	Light will be on when the power cord is plugged into AC power. This also indicates that the battery, if installed, is charging.
C	**Low Battery**	This light indicates that the cardiograph must be plugged in to recharge the battery.
D	On/Standby	Switches the cardiograph between **On** and **Standby**. Standby means the cardiograph is off but it is still keeping the battery charged as long as the cardiograph is plugged into AC power.
0	Chart Speed	Sequentially changes the chart speed from 5, ⇒ 10, ⇒ 25, ⇒ 50, ⇒ 5 mm/second.
1	ECG Size	Sequentially changes the limb and chest lead sensitivity from 5, ⇒ 10, ⇒ 20, ⇒ 5 mm/mV.
2	V Leads	Reduces the chest lead sensitivity to 50% of the value set by ECG Size.
3	Filter	Turns the Baseline Wander and Noise filters on or off. See "Auto Report Filters" in Chapter 2, and "Manual Report Filters" in Chapter 2 for more information.
4	Page Advance	Advances the paper to the beginning of the next page.
5	Auto	Starts an Auto ECG recording.
6	Manual	Starts a Manual ECG recording.
7		Sequentially changes the lead group used to generate a Manual ECG from I II III, ⇒ aVR aVL aVF, ⇒ II aVF V2, ⇒ V1-V6, ⇒ I II III.
8	Stop	Halts any cardiograph function.
9	Copy	Prints a copy of the last Auto ECG. If you want additional copies of an Auto ECG, you must print them before recording another Auto or Manual ECG.See "Making Copies of Auto ECGs" in Chapter 2, **Recording an ECG** for more information.

About Your Cardiograph

Your PageWriter 100 cardiograph:

- Acquires 12 leads simultaneously.
- Provides selectable Manual formats.
- Operates on a rechargeable battery. AC power charges the battery.
- Has a digital array printer with continuous-feed paper.
- Has a 200 sheet Z-fold paper capacity.

Accessories

Your cardiograph was shipped with one of three accessory sets, according to your geographic option:

No Electrodes — Options: ABB, ABD, ABE, ABF, ABH, ABS, ABU, ABX, ABZ, ACQ

- Power cord
- Patient Cable
- 1 package of paper
- *PageWriter 100 User's Guide*
- *Using the HP PageWriter 100 Cardiograph* operator training video

For electrodes, contact your local Hewlett-Packard Sales Office or your authorized Hewlett-Packard Dealer or Distributor.

Reusable Electrodes — Options: ABG, ABK, ABM, ABZ, AB4, AKV

- Power cord
- Patient Cable
- 1 package of paper
- 6 Welsh bulb electrodes
- 4 limb electrodes and straps
- 1 tube Redux® creme
- *PageWriter 100 User's Guide*
- *Using the HP PageWriter 100 Cardiograph* operator training video

Disposable Electrodes — Options: ABA, ABC

- Power cord
- Patient Cable
- 1 package of paper
- Disposable electrode starter set
- Tab electrode adapters
- *PageWriter 100 User's Guide*
- *Using the HP PageWriter 100 Cardiograph* operator training video

About This Manual

This guide contains concise operating instructions for cardiograph users. This manual describes how to perform the following tasks:

- Recording an ECG
- Troubleshooting
- Caring for and maintaining the cardiograph
- Preparing your cardiograph for use

Patient and Operational Safety Notes

Your cardiograph isolates all connections to the patient from electrical ground and all other conductive circuits in the cardiograph. This reduces the possibility of hazardous currents passing from the cardiograph through the patient's heart to ground. To ensure the patient's safety and your own, observe the following reminders.

- When operating your cardiograph from AC power, be sure it and all other electrical equipment connected to or near the patient are effectively grounded.

  Use only grounded power cords (three-wire power cords with grounded plugs). Also make sure the outlet accepts the plug and is grounded. *Never* modify a grounded plug to fit an ungrounded outlet, i.e. removing the ground prong or ground clip to fit an ungrounded outlet. Should an ungrounded plug adapter be necessary, use a ground strap to connect the equipotential connector at the rear of the instrument to the power source ground.

- The patient cable should be routed away from power cords and any other electrical equipment. Failure to do so can result in AC line frequency interference on the ECG trace.

Warning

The HP patient cable supplied with this cardiograph, or an approved HP substitute patient cable, is an integral part of the cardiograph's safety features. Using any other patient cable may compromise defibrillation protection as well as performance.

Only qualified personnel may service the cardiograph.

Warning

Do not use this cardiograph near flammable anesthetics. It is not intended for use in explosive environments.

Do not touch the patient, patient cable or cardiograph during defibrillation procedures. Death or injury may occur from the electrical shock delivered by the defibrillator.

Be sure that the electrodes or leadwire tips do not come in contact with any other conductive parts, including earth-grounded parts, especially when connecting or disconnecting electrodes to/from a patient.

The use of multiple instruments connected to the same patient may pose a safety hazard due to the summation of leakage currents from each of the instruments. Any such combination should be evaluated by local safety personnel before being put into service.

Do not pull on the paper while a report is being printed. This can cause distortion of the waveform and can lead to potential misdiagnosis.

Caution

Do not block the ventilation slots located on both sides and to the rear of the cardiograph. Lack of ventilation may cause cardiograph to overheat and components to fail.

- The Hewlett-Packard warranty is only assured if you use Hewlett-Packard approved accessories and replacement parts.

AC and DC (Battery) Operation

Your cardiograph requires the battery to be installed for proper operation—even if the cardiograph is plugged into AC power, it cannot print an ECG report without the battery. For information about replacing or installing the battery, refer to Appendix A, **Setting up Your Cardiograph for the First Time.**

The following is a list of AC and battery operating instructions:

- A fully charged battery (without AC power) will print approximately 40 Auto ECGs, or approximately 40 minutes of **continuous** Manual ECG information.
- The **Low Battery** light indicates the battery needs to be charged. If the **Low Battery** light begins to flash, this indicates the cardiograph is about to shut down due to a very low battery. Plug the cardiograph into AC power.
- From the time the **Low Battery** light first comes on to when the cardiograph automatically turns itself to **Standby** (off), there is typically enough reserve battery capacity to print two Auto ECG reports or 2 minutes of Manual ECG data. A weak or faulty battery will reduce this time.
- A discharged battery requires at least 5 minutes charging time, with the cardiograph in **Standby** (off), to print an Auto ECG.
- A discharged battery requires at least 10 minutes charging time, with the cardiograph in **Standby** (off), to print a 1-minute Manual ECG.

Note

If the cardiograph is turned on while the battery is being charged, these charging times are doubled (10 minutes for an Auto ECG and 20 minutes for a 1-minute Manual ECG).

- The PageWriter 100 cardiograph has a battery-saving feature: it will turn itself to **Standby** (off) after 30 minutes of instrument inactivity. This prevents the cardiograph from being accidentally left on for extended periods of time.

  This feature is **not** active if all the limb electrodes are connected to a patient or if the cardiograph is plugged into AC power.

- A new battery or a battery that has been stored for an extended period of time requires charging (with the cardiograph in **Standby** (off)) for 16 hours.
- The battery, if installed, is being charged any time the AC light is on.
- A fully depleted battery will charge to 90% of full capacity in 7 hours, and 100% capacity in 16 hours, as long as the cardiograph is in **Standby** (off) for the entire time.
- When the cardiograph is not in use, it should be connected to AC power and left in **Standby** (off). This will maintain a full battery charge and prolong battery life.

Note

The cardiograph's battery charging circuit delivers less power than the cardiograph uses while printing an ECG. If a Manual ECG is being recorded, the battery charge level will continue to drop until the instrument shuts itself down or is turned to **Standby** (off) by the operator.

Recording an ECG

2

Recording an ECG

This chapter describes how to prepare the patient for an ECG, record an ECG, understand the printed report, and change the ECG report format. Samples of the Auto and different Manual report formats are also shown.

Note

If the cardiograph has not been setup, refer to Appendix A for instructions.

The basic steps and procedures for recording an ECG are as follows:

1. If the cardiograph is not **On**, press (On/Standby).
2. Prepare the patient and apply the electrodes, as described in the "Preparing the Patient" section.
3. Press (Auto) or (Manual) to record the ECG.
4. Check the quality of the recorded ECG on the printed report.

The rest of this chapter discusses the details of setting up and recording ECGs and understanding the printed report.

Preparing the Patient

For electrode placement information, refer to the diagram on the top of your cardiograph. For tips on proper ECG technique, see the videotape *Using the HP PageWriter 100 Cardiograph*.

Note

Proper patient preparation and electrode placement are the most important elements in producing a high quality ECG trace.

Prepare the patient by performing the following steps.

1. Reassure and relax the patient. A calm and quiet patient produces the best ECGs.
2. Make sure each electrode site is not covered by hair or clothing.
3. Gently clean and abrade the surface of the skin with dry gauze.
4. Place electrodes on patient. See the notes below regarding your type of electrodes.

Note

The patient cable should be routed away from power cords and any other electrical equipment. Failure to do so can result in AC line frequency interference on the ECG trace.

Notes for Customers Using Reusable Electrodes

Each electrode must be attached securely. Straps must neither slide nor be so tight as to cause discomfort.

The electrode paste, gel, or creme must cover an area the size of the electrode, but must not extend beyond it, especially on the chest.

Notes for Customers Using Disposable Tab Electrodes

Disposable electrodes have conductive material on one side only, the adhesive side. The electrode tab must be

placed between the jaws of the electrode adapter and remain flat. Do not attempt to place the jaws of the electrode adapter so close to the circular part of the electrode that the tab of the electrode is bent or contact is made with the conductive gel. Gently tug on the electrode adapter to ensure that the electrode adapter is properly placed on the electrode.

Good and accurate placement on the first attempt should be your goal for each electrode. Each time an electrode is lifted off the skin and attached again, the conductive gel becomes weaker and less effective.

Understanding When a Signal is Acquired

Your PageWriter 100 cardiograph attempts to acquire a good signal for an Auto report before you press the Auto key. Hewlett-Packard calls this **Pre-acquisition**. Pre-acquisition is activated when the cardiograph is turned on and remains active until an Auto report begins to print. Pre-acquisition is deactivated by printing an Auto report to allow for copies of the Auto report to be printed (see "Making Copies of Auto ECGs"). Pre-acquisition is also deactivated whenever an electrode is disconnected.

Pre-acquisition is reactivated when a Manual report is finished printing.

When Pre-acquisition is active, it is important for the patient to stay still and relaxed. This will help ensure a good signal is captured prior to printing an Auto report.

Note

Pre-acquisition is not used for Manual ECG reports. Manual ECG reports display ECG data in real-time.

Recording an Auto ECG

To record an Auto ECG, perform the following steps.

1. If the cardiograph is not **On**, press (On/Standby). The front panel lights are lit as the cardiograph performs a short power-on sequence.
2. Prepare the patient and apply the electrodes.
3. Press (Auto) on the front panel.

   The light above the (Auto) key flashes while the cardiograph is acquiring the ECG. (If the (Auto) light flashes in an alternating pattern with the (Manual) lights a **leads off** condition is indicated. See "Correcting a Leads Off Condition" below.) When the cardiograph begins printing the ECG, the (Auto) light stays on. When the cardiograph has completed the report, the light turns off.

Correcting a Leads Off Condition

A leads off condition is caused by the patient cable not being connected to the cardiograph, one or more leadwires not being connected to electrodes, or poor contact between the patient and one or more electrodes. The cardiograph signals a leads off condition only during the acquisition of an Auto ECG. The operator can check for a leads off condition anytime an ECG report is printed by checking for traces consisting of dashed lines or by checking the upper left corner of the Auto ECG report for a leads off message. The leads off message lists the lead wires or electrodes that have a leads off condition. Table 2-1 shows the possible leads off messages, and the lead wire and electrode to check for each one. To correct a leads off condition, perform the following steps.

1. Check that the patient cable is properly connected.
2. Recheck the steps you performed when preparing the patient. Pay particular attention to the proper application of the electrodes and the connections between leadwires and electrodes.

Table 2-1. Leads Off Labels

Designator (AHA/IEC)	Meaning
RL/N	Right leg electrode not connected, or only right leg electrode is connected and all other limb electrodes are not connected.
RA/R	Right arm electrode is not connected.
LA/L	Left arm electrode is not connectd.
LL/F	Left leg elecrode is not connected.
V1 ... V6/ C1 ... C6	One or more chest electrodes are not connected. For example, V2 means the V2 electrode is not connected.

Auto Report Filters

The PageWriter 100 allows you to choose between two sets of filters for Auto ECG reports:

- The 0.15–40 Hz filters (0.15 Hz Baseline Wander and 40 Hz Noise) are enabled when the Filter light is on. It delivers the least amount of noise.
- The 0.15–150 Hz filters (0.15 Hz Baseline Wander and 150 Hz Noise) are enabled only when the Filter light is off. It delivers the highest fidelity signal, but unless ECG signal conditions are excellent, it can record noise.

Table 2-2 shows when each filter is enabled.

Table 2-2. Auto Filter Settings

Default (Filter light on)	Filters Off (Filter light off)
0.15–40 Hz	0.15–150 Hz[1]

1 Conforms to AAMI specifications

Making Copies of Auto ECGs

If you require additional copies of an Auto ECG, you may copy the last ECG that was recorded.

To copy your most recent Auto ECG, press the Copy key.

Note

- You must copy the ECG before the cardiograph has been turned to **Standby** (off) and before another ECG has been acquired.
- You may change the speed (25 or 50 mm/sec) prior to printing a copy of an ECG.
- You can only print copies of Auto ECGs.

Recording a Manual ECG

To record a Manual ECG, perform the following steps.

1. If the cardiograph is not **On**, press (On/Standby). The front panel lights are lit as the cardiograph performs a short power-on sequence.
2. Prepare the patient and apply the electrodes.
3. Press (7) until the light above the desired lead group is lit.
4. Choose the desired (Chart Speed), (ECG Size), and (V Leads) sensitivity.
5. Press (Manual) on the front panel.
6. Inspect the ECG as it prints.
   If any of the traces consist of a dotted line, signifying **leads off**, press (Stop) and refer to "Correcting a Leads Off Condition".
   If you would like to try to improve one or more leads, press (Stop) and adjust the electrodes accordingly.
   After making adjustments, press (Manual) to restart the recording.

   The cardiograph will print the ECG continuously until you press the (Stop) key.

Note

If accurate ECG ST contours are required in Manual mode, turn off the (Filter) key to activate the 0.15–150 Hz filters. See "Manual Report Filters" for more details.

Changing Manual Report Settings

The following Manual report settings can be changed while a Manual report is printing:

- Chart Speed
- ECG Size
- V Leads sensitivity
- Filter
- Lead group selection (7)

Each can be changed by pressing the appropriate key. There is no need to press Stop prior to changing settings.

Restoring the ECG Trace After Defibrillation or Reconnecting Leads

After an application of a defibrillator pulse, reconnecting one or more leads, or any other time the ECG trace is off-center during a Manual report, the trace can be quickly restored by pressing the Manual key again.

Manual Report Filters

The PageWriter 100 allows you to choose between two sets of filters for Manual ECG reports:

- The 0.05–40 Hz filters (0.05 Hz Baseline Wander and 40 Hz Noise) are enabled when the Filter light is on. It delivers the least amount of noise.
- The 0.05–150 Hz filters (0.05 Hz Baseline Wander and 150 Hz Noise) are enabled only when the Filter light is off. It delivers the highest fidelity signal, but unless ECG signal conditions are excellent, it can record noise.

Table 2-3 shows when each filter is enabled.

Table 2-3. Manual Filter Settings

Default (Filter light on)	Filters Off (Filter light off)
0.05–40 Hz	0.05–150 Hz[1]

1 Conforms to AAMI specifications

Understanding the Printed Report

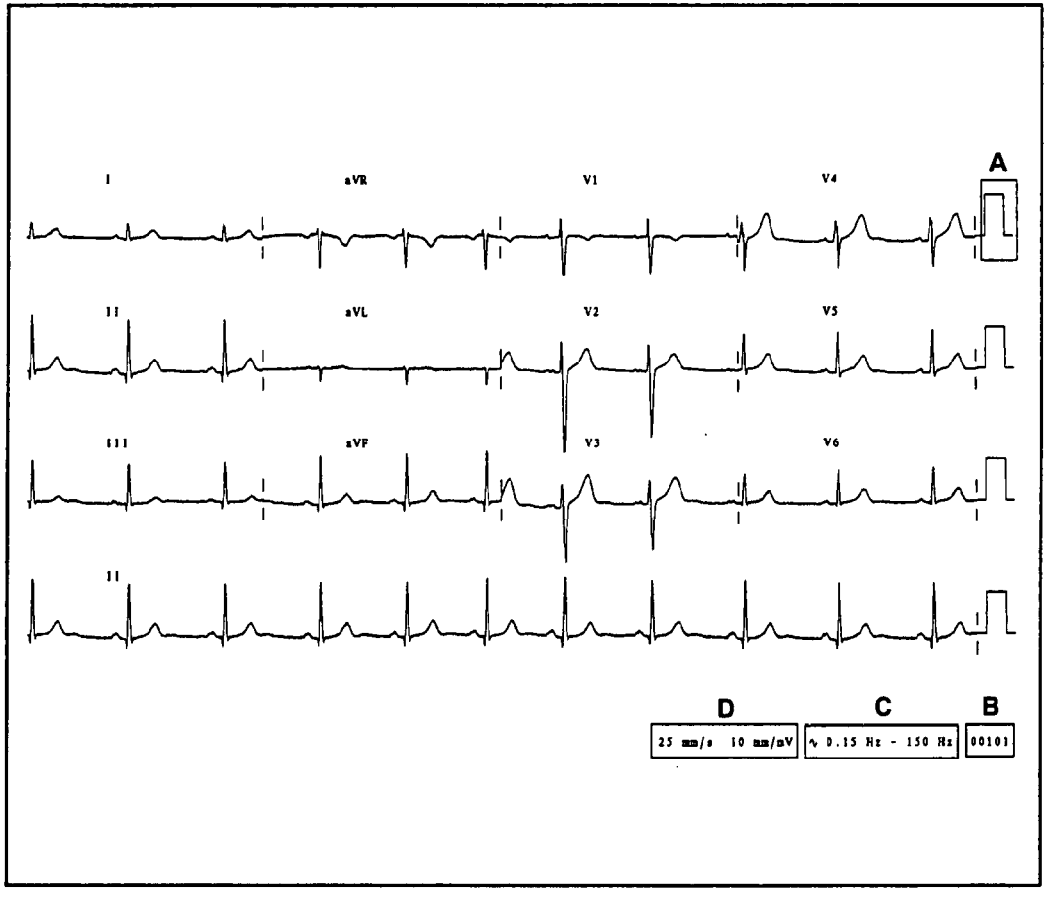


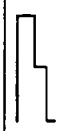
Figure 2-1. The Auto ECG Report.

Table 2-4. Auto ECG Report Annotations

	Description
A	Leads off indicators
B	Calibration signal. See Table 2-5.
C	Cardiograph settings for speed and for limb and chest lead sensitivity.
D	Filter settings: * AC filter (∿) * Frequency range * Baseline Wander filter (W).
E	Sequence number, the total number of ECGs the cardiograph has recorded.

The following table shows how the height of the calibration pulse indicates ECG sensitivity.

Table 2-5. Calibration Signals

ECG Size mm/mV	V Leads Indicator	ECG Size (mm/mV)		Calibration Pulse		
		Limb Leads	V Leads (V1 - V6)	Auto	Manual	
					Limb Leads	V Leads
5	off	5	5			
5	on	5	2.5			
10	off	10	10			
10	on	10	5			
20	off	20	20			
20	on	20	10			

Choosing a Report Format

An Auto report prints a one-page (at 25 mm/sec) or two-page (at 50 mm/sec) summary of all 12 ECG leads. A Manual report presents a continuous printout of the selected lead group until the Stop key is pressed.

Auto Report Format

The Auto report format is a standard 12-lead ECG with a lead II rhythm strip. Figure 2-2 is an example of the auto report format.

Manual Report Formats

Manual ECGs reflect the ECG waveform as it occurs and there is no significant delay in the recording.

Alternate lead groups can be selected while recording a 3- or 6-lead ECG by pressing 7 until the light above the desired lead group is lit. The following table shows the available lead group choices.

Table 2-6. Manual Lead Groups

Number of Leads	Light on (from left)	Lead Groups
3	Leftmost	I, II, III
	2nd	aVR, aVL, aVF
	3rd	II, aVF, V2
6	Rightmost	V1, V2, V3, V4, V5, V6

An Auto Report Example

The following figure is an example of the Auto ECG report format.

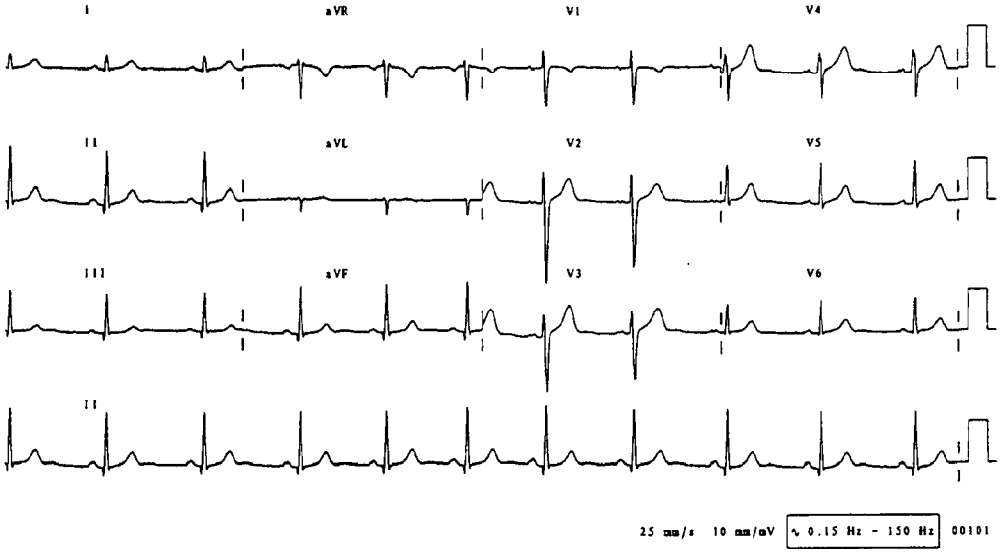


Figure 2-2. An Auto 3x4 ECG with One Rhythm Strip(3x4, 1R).

Manual Report Examples

The following figures show examples of Manual ECG report formats.

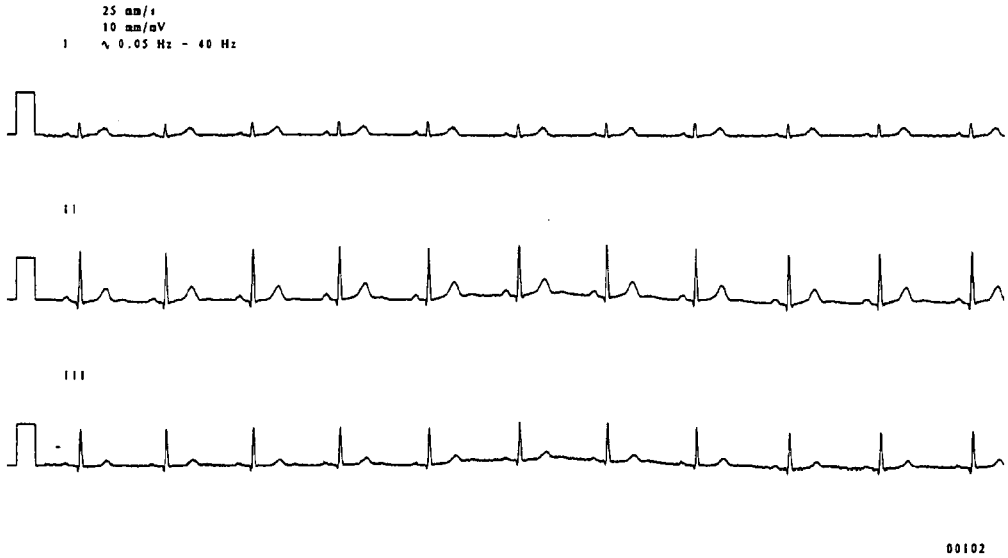


Figure 2-3. A Manual 3-Lead ECG.

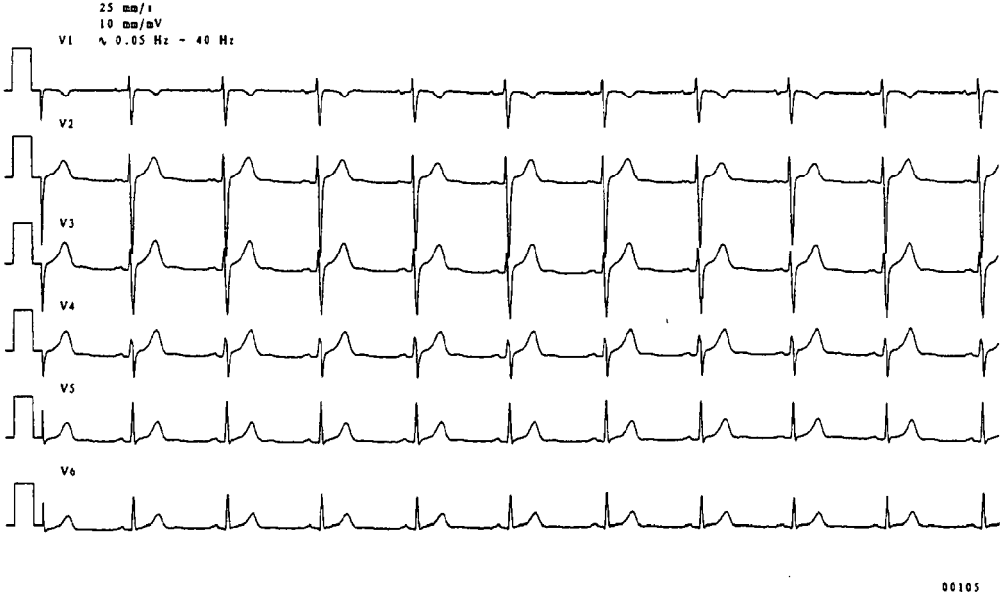


Figure 2-4. A Manual 6-Lead ECG.

Troubleshooting

3

Troubleshooting

Your cardiograph is designed for reliable operation. If you have problems with an ECG, there are several things you can check before calling for service. This chapter tells how to solve basic ECG problems.

Checking ECG Technique

Many problems in taking an ECG may be related to electrode application. Review "Preparing the Patient" in Chapter 2, **Recording an ECG** to assure the patient leads are properly attached to the patient.

Identifying ECG Problems

The following table shows symptoms and solutions to problems that can occur when recording an ECG.

Table 3-1. ECG Problems and Solutions

Problem	Cause	Possible Solutions
Power line AC Interference	Poor electrode contact. Dry or dirty electrodes.	Reapply electrodes. Abrade skin. Use new electrodes.
	Lead wires may be picking up interference. One possibility is a poorly grounded instrument near patient.	Route electrode wires along the limbs and away from any other electrical equipment. Fix other equipment. Unplug cardiograph from AC power and operate on battery only.
	Patient cable is located too close to the cardiograph's power cord or other power cords.	Move cardiograph further away from patient. Unplug cardiograph from AC power and operate on battery only. Move other instruments further away from patient. Unplug electric bed.
Wandering Baseline	Patient movement.	Reassure and relax the patient.
	Electrode movement. Poor electrode contact & skin preparation.	Be sure that the lead wires are not pulling on the electrodes. Reapply electrodes. Make sure the Filter light is on.
	Respiratory interference.	Move lead wires away from areas with greatest respiratory motion.

Table 3-1. ECG Problems and Solutions (continued)

Problem	Cause	Possible Solutions
Tremor or Muscle Artifact 	Poor electrode placement. Poor electrode contact. Patient is cold. Tense, uncomfortable patient. Tremors.	Clean the electrode site. Reapply electrodes. Be sure that the limb electrodes are placed on flat, non-muscular areas of the body. Warm the patient. Reassure and relax the patient. Make sure the Filter light is on. Attach electrodes high on the extremities near the trunk. Make sure the Filter light is on.
Intermittent or Jittery Waveform 	Poor electrode contact. Dry electrodes. Faulty lead wires.	Clean the site. Reapply electrodes. Replace faulty patient cable.
Poor print quality (uneven contrast or blank streaks)	Dirty printhead.	Clean the printhead. Use HP recommended paper.

If the Recording Won't Start

If you press (Auto) or (Manual) and the recording doesn't start, investigate the following possibilities:

- Is the cardiograph turned on?

  At least one light other than the AC light should be on.

- Is the AC power light on?

  If the cardiograph is plugged into AC power and the AC light is not on, check the two line fuses. See "Replacing the Fuses" in Chapter 4, **Maintaining the Cardiograph** for fuse information.

- Is the patient cable connected to the cardiograph?

  Visually check the connection between the cardiograph and the patient cable.

- Is the battery adequately charged?

  The Low Battery light should be off.

- Is the cardiograph out of paper? Is the paper jammed in the cardiograph?

  The cardiograph will not record an ECG unless you have loaded paper or cleared the paper jam. See Appendix A, **Setting up Your Cardiograph for the First Time** for details on loading the paper. Reloading the paper will clear a paper jam.

- Is the paper sensor lens dirty?

  Clean the paper sensor lens. See Chapter 4, **Maintaining the Cardiograph** for more information.

- Is the paper door completely closed?

  Open the paper door slightly and close it tightly. Listen for the door safety latch to lock.

If the cardiograph still won't operate, perform the following steps.

1. Switch the cardiograph to **Standby** (off) with the [On/Standby] switch.
2. Wait 20 seconds and then switch the cardiograph back to **On**.
3. Press [Auto] or [Manual]. If the cardiograph turns itself to **Standby** (off), the battery is not operating properly.

If the cardiograph still won't operate, call your local Hewlett-Packard service representative.

If the Cardiograph Won't Print a Manual Report

- Is the paper sensor lens dirty or obstructed?

  Clean the paper sensor lens. See Chapter 4, **Maintaining the Cardiograph** and Figure 4-1 for more information.

- Is the cardiograph out of paper?

  Load paper. See *Loading the Paper* in Chapter 4, **Maintaining the Cardiograph**.

Maintaining the Cardiograph

4

Maintaining the Cardiograph

Care and Cleaning

The outside surfaces of the cardiograph and its accessories (except the patient cable) are designed to be cleaned by mild soap and water or isopropyl alcohol. The patient cable can be cleaned only with mild disinfectant or soap and water. The patient cable cannot be cleaned with isopropyl alcohol.

Cleaning the Cardiograph

1. Unplug the power cord and ensure that the cardiograph is in **Standby** mode (all lights are off).
2. Wipe the external surfaces of the cardiograph with a soft cloth dampened with mild soap and water or isopropyl alcohol. Avoid applying cleaning fluids to the cable connectors.

Caution

Do not use any strong solvents or abrasive cleaning materials.

Do not spill any liquids on the surface of the cardiograph. Immediately have the cardiograph serviced if any liquids spill on the surface of the cardiograph.

Do not use the following to clean the cardiograph:

- Acetone
- Iodine-based cleaners
- Phenol-based cleaners
- Ethylene Oxide Sterilization
- Chlorine bleach
- Ammonia-based cleaners

Cleaning the Electrodes and Cables

Clean the electrodes and patient cables with a soft cloth moistened with a recommended disinfectant or cleaning agent from the following list:

Cetylcide® (may discolor cable)
Cidex®
Lysol® Disinfectant
Lysol® Deoderizing Cleaner (may discolor cable)
Dial® Liquid Antibacterial Soap
ammonia
409® (may discolor cable)
10% solution of Clorox® in water (may discolor cable)
Murphy® Household Cleaner, or
Ves-phene II®.

Wring any excess moisture from the cloth before cleaning.

Caution

- Do not clean the patient cable with alcohol. Alcohol can cause the plastic to become brittle and may cause the cable to fail prematurely.
- Do not autoclave the cable or use ultrasonic cleaners.
- The patient cable is not immersible.
- Do not use abrasive materials to clean metal surfaces—scratches on them can cause artifacts.
- Avoid wetting the connectors.

Cleaning the Digital Array Printhead and Paper Sensor

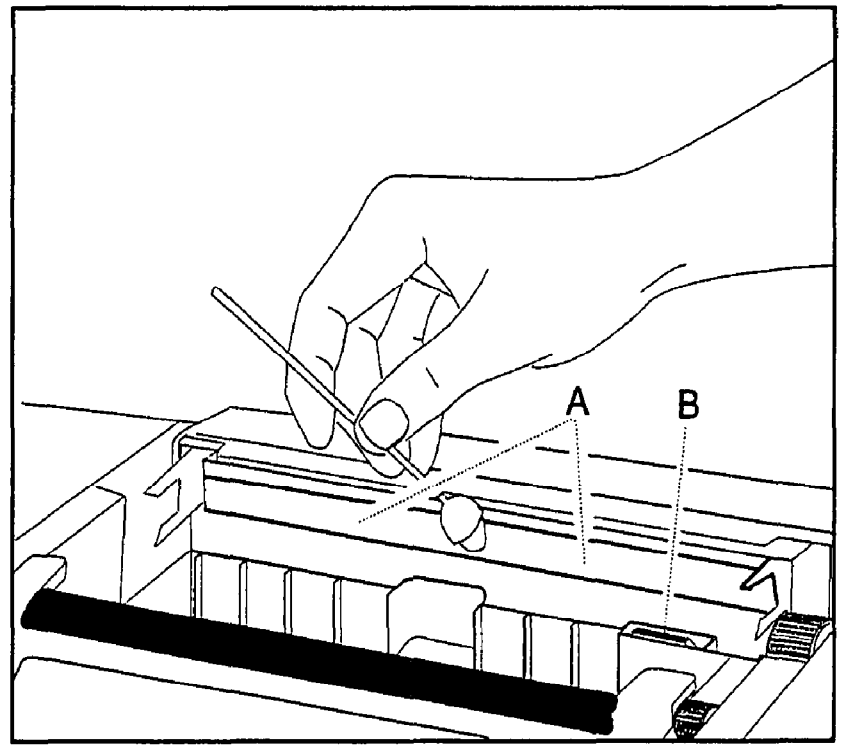


Figure 4-1. Cleaning the Digital Array Printhead.

A. Printhead
B. Paper Sensor

If the print quality is uneven, it may be due to a dirty printhead. How frequently you must clean the printhead depends on how many ECGs you print and the quality and type of paper you use.

If the paper fails to stop at the end of a page, the paper sensor lens may be dirty.

To clean the printhead:

Caution

Touch the equipotential connector on the back of the cardiograph to discharge any static electricity stored on your skin before touching the printhead. The printhead can be damaged by static electricity.

1. From the front of the cardiograph, unlatch and open the paper door. The printhead is to the right under the paper blade and behind a brush. See Figure 4-1.
2. Wipe the printhead with a foam swab dipped in 90% isopropyl alcohol. Scrub until all visible residues are removed.
3. Dry the printhead with a clean lint-free tissue.

To clean the paper sensor lens:

1. From the front of the cardiograph, unlatch and open the paper door. The paper sensor lens is to the right under the printhead. See Figure 4-1.
2. Lightly wipe the paper dust off of the paper sensor lens with a dry foam swab. Do not use alcohol.

Loading the Paper

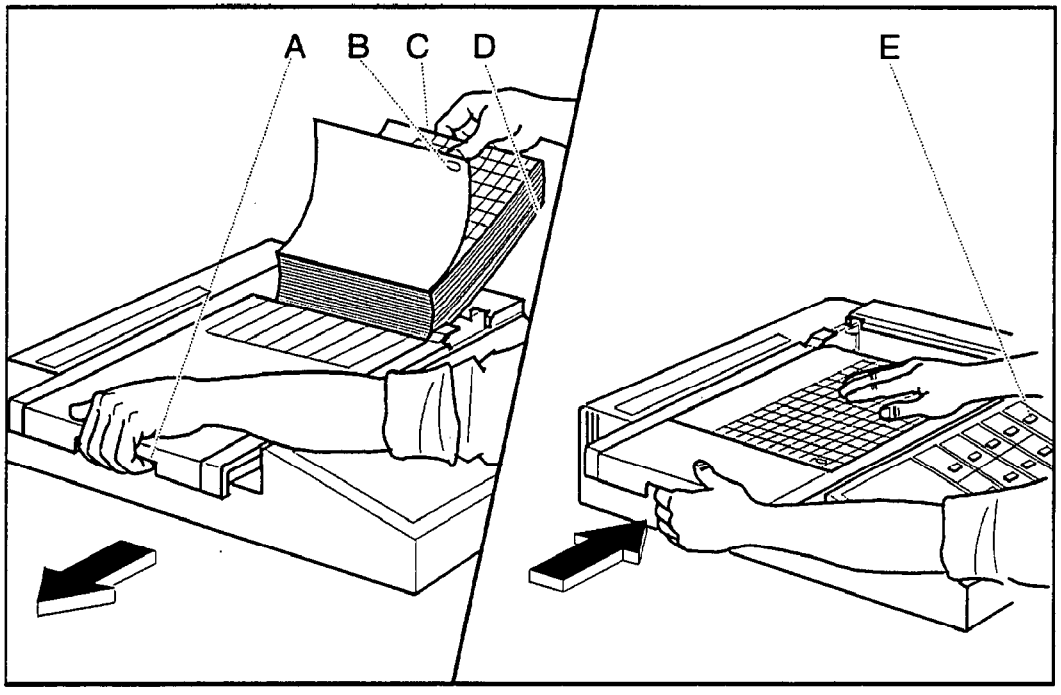


Figure 4-2. Loading the Paper.

A. Paper Door Latch
B. Paper Sensing Hole
C. Paper
D. Cardboard Backing
E. [Page Advance] Key

The cardiograph uses continuous-feed Z-fold paper. For best results use Hewlett-Packard paper. See "Supplies" for ordering information.

To load the paper:

1. From the front of the cardiograph, release the latch on the left side and slide the paper door to your left.
2. Remove the outer packaging on the paper stack.
3. Place the paper stack in the compartment so that the top side of the paper feeds grid side up over the top panel. The paper sensing hole will be in the lower corner of the paper.
4. Pull a sheet halfway out and over the paper door. Make sure that the paper lays on the black roller evenly within the channel of the paper door. See Figure 4-2.
5. Slide the paper door back into place. Make sure that the door is latched.
6. Press (On/Standby) to turn **On** the cardiograph, if necessary. Press (Page Advance) to advance the paper to the beginning of the next page.

Storing the Paper and Patient ECG Records

Recordings on standard chemical/thermal paper decompose naturally over time. With proper storage and handling, recordings on these papers have been shown to be readable for approximately 5 years. Proper storage and handling before and after recording includes:

1. Store the paper under cool and dry conditions. Temperatures must not exceed 40 ° C (104° F) and relative humidity must be below 80%.
2. Store recorded ECGs in manila folders, or in sheet protectors made of polyester, polyimide, polypropylene, or acetate, in areas as described above. Do not store ECGs in vinyl sheet protectors, as noted below.

Storing the paper as indicated above will minimize trace fading and background development (darkening). However, storing the paper as indicated above does not protect against trace fading or background development from the sources below.

To avoid trace fading or background development, the paper must not be exposed to or come in contact with the following, either before or after recording:

- Solvent-based adhesives, as used in mounting forms, pressure-sensitive tapes, labels, and common mending tapes. Starch- or water-based adhesives may be used.
- Plastics containing plasticisers, such as vinyl chlorides (PVC) typically found in vinyl sheet protectors, separators and plastic envelopes. Other plasticisers include polyethylene glycol, dioctyl phthalate, and dioctyl adipate.
- Glossy (or non-glossy) papers containing tributyl phosphate, dibutyl phthalate, or other organic solvents, such as FAX and other non-chemical/thermal recording paper, or product literature.
- Liquid or vaporous solvents, such as alcohols, ketones, esters, ethers, etc. Note that many of these solvents are found in felt-tip and other marking pens.
- Petroleum-based solvents, such as toluene, benzene, and gasoline.
- Bright light or UV sources such as sunlight, flourescent and related light sources.
- Chemicals containing castor oil, ammonia, some chemicals found in common hand and face creams, or citric acid (found in fruit juices).
- Forms containing carbon or carbonless (NCR) copy sheets.
- Pastes, creams or gels commonly used for ECG or ultrasound tests that contain any of the above or related chemicals.

If original recordings are stored, HP recommends that records be checked annually to determine their integrity. However, where long term storage is desired,

the user should consider photocopying or microfilming, or electronic or optical storage or a fade resistant paper.

HP's PTP™ brand thermal papers offer improved archivability. See "Supplies" for ordering information.

Caring for the Battery

Your cardiograph requires the battery to be installed for proper operation—even if the cardiograph is plugged into AC power, it cannot print an ECG report without the battery. For information about replacing or installing the battery, refer to Appendix A, **Setting up Your Cardiograph for the First Time.**

The sealed lead-acid battery used in the PageWriter 100 will provide optimum life when the unit is continuously connected to AC power and fully charged after each use. A depleted battery requires 16 hours of continuous charge time to fully charge. Because it is not always possible to allow a full charge cycle between uses, the PageWriter 100 was designed to charge a depleted battery to 90% of its capacity in approximately 7 hours.

Caution

Repeated undercharging of the battery will damage the battery and reduce battery life.

Note

Hewlett-Packard recommends that the cardiograph be plugged into AC power whenever possible to maximize battery life.

Battery life varies by how the battery is maintained and how much it is used. For improved battery life, keep the instrument plugged in when not in use. If the battery has been fully charged and requires recharging after a few ECGs, consider replacing it. Use only HP battery, part number M2460A.

Note

Battery should be removed from unit and placed in storage if cardiograph will not be used for more than three months without AC power.

Storing the Battery

To prepare the battery for storage, charge it in the cardiograph for 16 hours. Then remove it from cardiograph and store it in a cool, dry location. Recharge a lead-acid battery in storage for at least 16 hours every six months. This ensures that the battery does not completely discharge while in storage. The battery's shelf life is longer with cooler temperatures, but do not store below freezing level.

Replacing the Fuses

To replace the AC fuses:

1. Unplug the cardiograph from AC power.
2. Turn the cardiograph bottom-side up.
3. Locate the two AC fuse holders on the bottom of the cardiograph, as shown in Figure 4-3.
4. Using a screwdriver, turn the fuse cap 1/2-turn counter-clockwise. As the fuse cap is untwisted, it extends above the surface of the cardiograph case.
5. Pull the fuse cap straight up approximately 2-1/2 cm (1-inch), until it stops.
6. Remove the fuse. You may need to tap the fuse holder to shake the fuse out.
7. Insert a new fuse in the holder, slide the fuse cap back into the case. Fuse must be of the same type and rating as described on the label located next to the fuse holders.
8. Tighten the fuse cap 1/2-turn clockwise.

9. Repeat the operation for the other AC fuse.

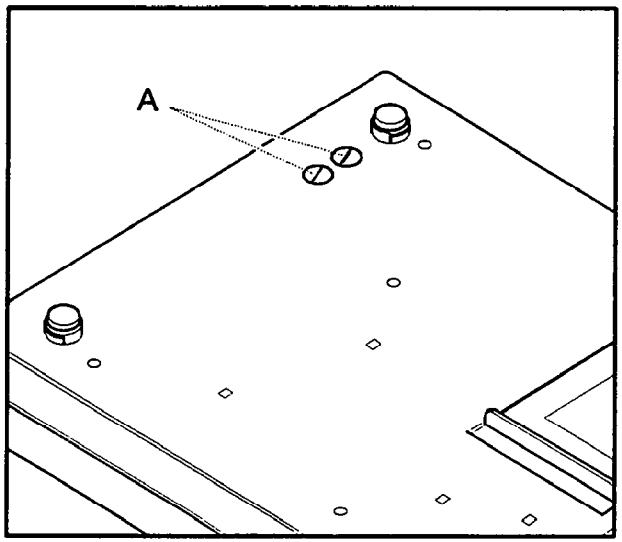


Figure 4-3. The AC Fuse Holders.

A. AC Fuse holders (2)

Supplies

Hewlett-Packard offers a full range of supplies for cardiographs. The following list is a collection of the most frequently ordered items. Pricing and availability of these and other supplies are available from Hewlett-Packard's Medical Supplies Centers.

- USA: Call 1-800-225-0230
- Outside USA: Please contact your local Hewlett-Packard Sales Office or your authorized Hewlett-Packard Dealer or Distributor.

Paper

M2481A	Paper, 8.5" x 11", 1600 sheets, with header
M2482A	Paper, 8.5" x 11", 1600 sheets, no header
M2483A	Paper, 210 x 300 mm, 1600 sheets, with header
M2484A	Paper, 210 x 300 mm, 1600 sheets, no header
M2485A	Paper, PTP brand Anti-fade, 8.5" x 11", 1600 sheets, with header
M2486A	Paper, PTP brand Anti-fade, 210 x 300 mm, 1600 sheets, with header

Battery

M2460A	Battery assembly

Patient Cable

M2461A	AHA Patient Cable with leads
M2462A	IEC Patient Cable with leads

Carrying Case

M2463A	Soft Carrying Case

Redux

651-1021-010	Redux Creme; 4 oz tube; 10 tubes per box
651-1008-010	Redux Paste; 5 oz tube; 10 tubes per box
651-1024-010	Redux Gel; 4 oz tube; 10 tubes per box
40481B	Redux Infant Creme; 5 oz bottle; 12 bottles per box

Electrodes

40490E	Welsh electrode; 15mm base 5cc bulb; screw connection(IEC)
40491E	Limb Plate Electrode(IEC) (4 per pack)
40421A	Welsh electrodes; 15mm base 5cc bulb; push-in connection(AHA) (6 per box)
40424A	Limb Plate Electrode(AHA) (4 per pack)
14030A	15" Rubber strap for limb plate electrode
40420A	Disposable diagnostic pre-gelled electrode (1,000 pieces)
13943B	Disposable diagnostic solid gel electrode (1,000 pieces)
13943D	Disposable diagnostic solid gel electrode (1,000 pieces) (United States and Canada only)
13944B	Disposable diagnostic wet gel electrode (300 pieces)

Lead Adapters

13946B	Universal ECG Adapter (10)
14282A	Snap Electrode Adapter for $\frac{1}{8}$" post leads, spring clip (5 per box)
40498E	Snap Electrode Adapter for 4 mm banana leads, grabber (10 per box)

Cart

M1705B	Cart

Fuses

2110-0620	AC fuse; 0.4 Amp 250 V
2110-0930	Battery fuse

Calling for Service

United States of America

HP Medical Response Center
Tel: 1-800-548-8833

Canada

Eastern Region
Tel: 1-800-361-9790

Central Region
Tel: 1-800-387-3900

Western Region
Tel: 1-800-661-5626

Other International Areas

European Headquarters
Tel: 22 838-111

France
Tel: (1)60 77 80 00

Austria, Eastern Europe
Tel: 0222/25 00-333

Germany
Tel: 02102-9060

Belgium
Tel: 02/778 35 31

Mediterranean and Middle East
Tel: (41) 22 780 4111

Netherlands
Tel: 20/547 69 11

Spain
Tel: 1/637 00 11

Norway
Tel: 2/24 60 90

Sweden
Tel: 8/444 22 30

Denmark
Tel: 2/81 66 40

United Kingdom
Tel: 44 344 366 333

Finland
Tel: 90/887 21

Italy
Tel: 2/921 22 833

Setting up Your Cardiograph for the First Time

A

Setting up Your Cardiograph for the First Time

Before using your cardiograph for the first time you must prepare it by performing the following tasks:

- Check the voltage setting
- Install the battery
- Connect the cables
- Load the paper

Checking the Voltage Setting

Your cardiograph can be set to operate at nominal line voltages of 115 or 230 Volts (see the following **Note**). The line voltage was set at the factory to the setting for your area. However, it is a good idea to check this setting. Refer to Figure A-1 for the physical location of the voltage select switch. To check the voltage setting, perform the following steps.

1. Locate the voltage select switch on the back of the cardiograph. See Figure A-1.
2. Verify that the correct voltage is visible on the voltage select switch. If the voltage setting is incorrect, slide the voltage switch so the correct voltage is visible. The cardiograph operates with any line frequency from 50 to 60 Hz.
3. Remove and discard the label that covers the AC power receptable. See Figure A-1 for the location of the AC power receptable. The purpose of the label is to remind you to check the setting of the voltage select switch.

Caution

The cardiograph can be damaged if plugged into the incorrect voltage.

Note

The nominal 115 VAC voltage setting works equally well for any voltage between 100–120 VAC. The nominal 230 VAC voltage setting works equally well for any voltage between 220–240 VAC.

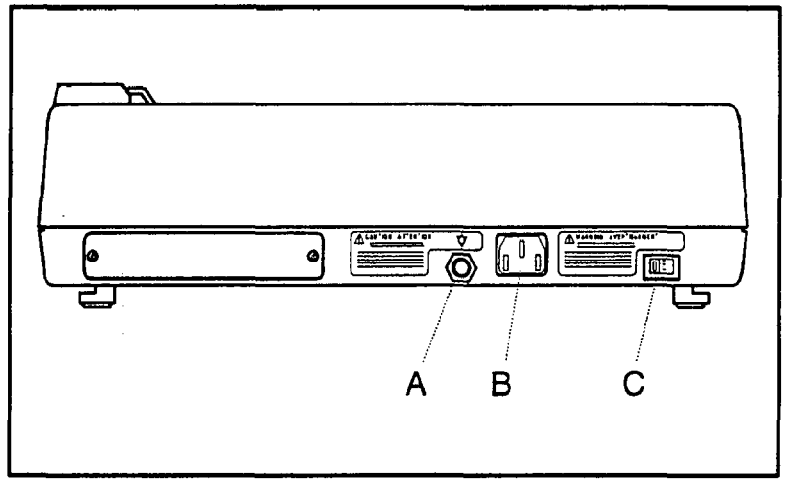


Figure A-1. Rear View of Cardiograph

A. Equipotential Connector
B. AC Power Receptacle
C. Voltage Select Switch

Note

The equipotential connector is only used when the cardiograph must be plugged into an ungrounded outlet. See "Patient and Operational Safety Notes" in Chapter 1, **Getting Acquainted** for more information about using the equipotential connector.

The Battery

Your cardiograph requires the battery to be installed for proper operation—even if the cardiograph is plugged into AC power, it cannot operate without the battery.

Use only HP batteries, part number M2460A, in the cardiograph.

Installing the Battery

To install the battery:

Note

Do not remove the shrinkwrap surrounding the battery.

Note

When you install the battery you may notice a screw hole located near the battery compartment. This screw hole is the mounting point for the optional M1705B cart. The mounting thumbscrew is supplied with the cart.

1. Make sure the cardiograph is unplugged from AC power.
2. Turn the cardiograph bottom-side up.
3. Slide the battery door in the direction of the arrow until it unlatches (approximately 1/2 inch), as shown in Figure A-2. Lift off the door.
4. Install the new battery in the battery compartment as shown in Figure A-3 and plug the battery connector into the cardiograph.
5. Place the battery door into its slots and slide the door in the opposite direction of the arrow until it latches, as shown in Figure A-2.
6. Turn the cardiograph top-side up.
7. Plug the cardiograph into AC power.
8. Check that the AC indicator light is on. The unit is now in **Standby** (off) mode with the battery charging.

After you finish setting up the cardiograph, it may be used on a limited basis until the battery has been fully charged. Hewlett-Packard recommends charging the

battery as soon as possible for at least 16 hours. To charge the battery, plug the cardiograph into the wall outlet with the On/Standby switch set to **Standby** (off).

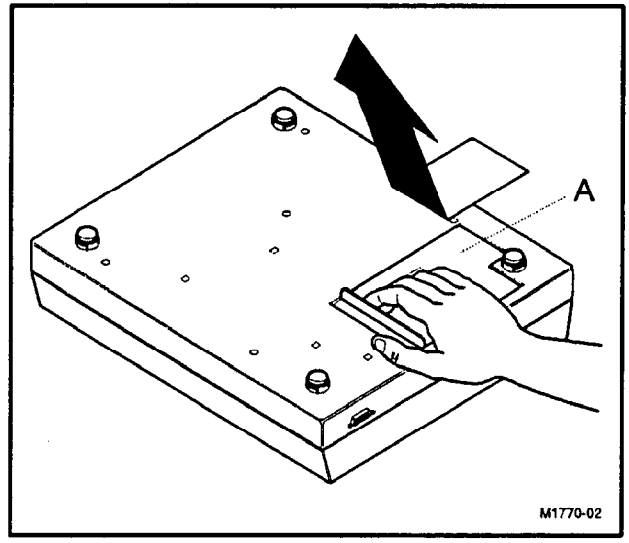


Figure A-2. Removing the Battery Door.

A. Battery Door

Removing the Battery

To Remove the Battery:

1. Unplug the cardiograph from AC power.
2. Turn the cardiograph bottom-side up.
3. Slide the battery door in the direction of the arrow until it unlatches (approximately 1/2 inch), as shown in Figure A-2. Lift off the door.
4. Unplug the battery connector from the cardiograph by squeezing the edges of the connector and pulling it straight out from the cardiograph.
5. Remove the battery and cable.
6. If the battery has been removed for storage, replace the battery cover by placing the battery door into its

slots and sliding the door in the opposite direction of the arrow until it latches, as shown in Figure A-2.

Warning **Properly dispose of or recycle depleted batteries according to local regulations. Do not disassemble, puncture or incinerate the disposed batteries.**

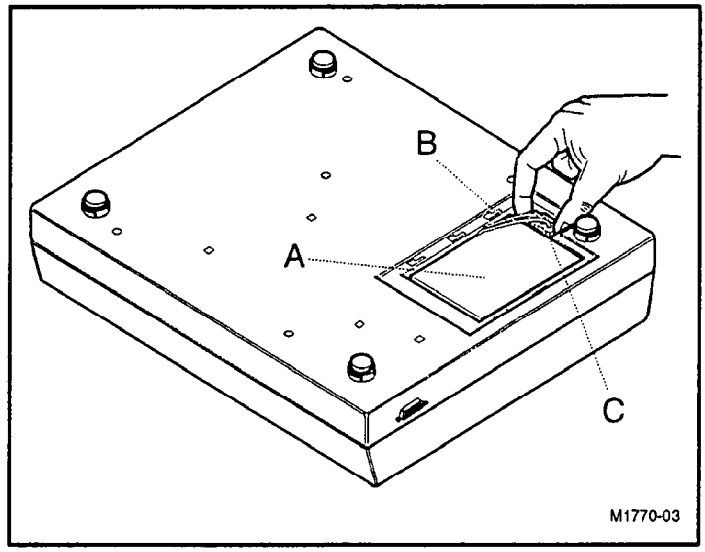


Figure A-3. The Battery Compartment.

A. Battery
B. Battery Cable
C. Battery Connector

Connecting the Cables

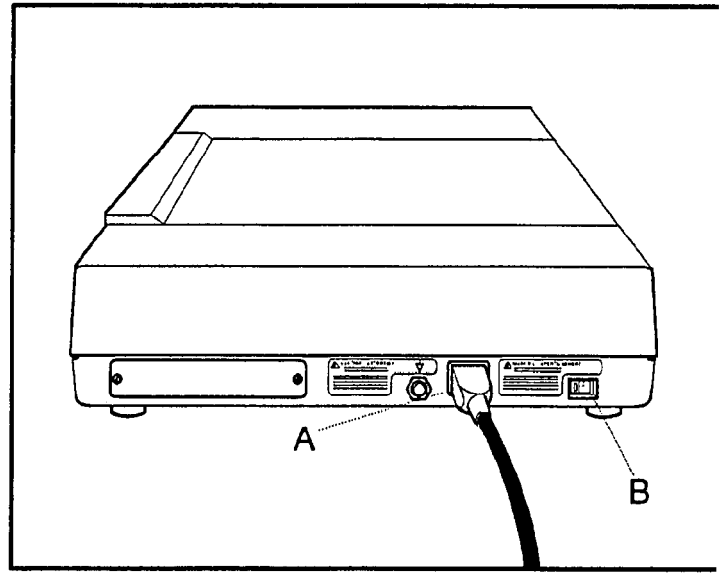


Figure A-4. Connecting the Power Cord.

A. Power Cord
B. Voltage Select Switch

1. Connect the power cord to the cardiograph as shown in Figure A-4.
2. Plug the power cord into the wall outlet.

Warning

If you must use an ungrounded plug adapter to plug the power cord into the wall outlet, you must also use a ground strap to connect the equipotential connector at the rear of the cardiograph to the power source ground. Figure A-1 shows the location of the equipotential connector. Refer to the "Patient and Operational Safety Notes" in Chapter 1, Getting Acquainted for more information about using the equipotential connector.

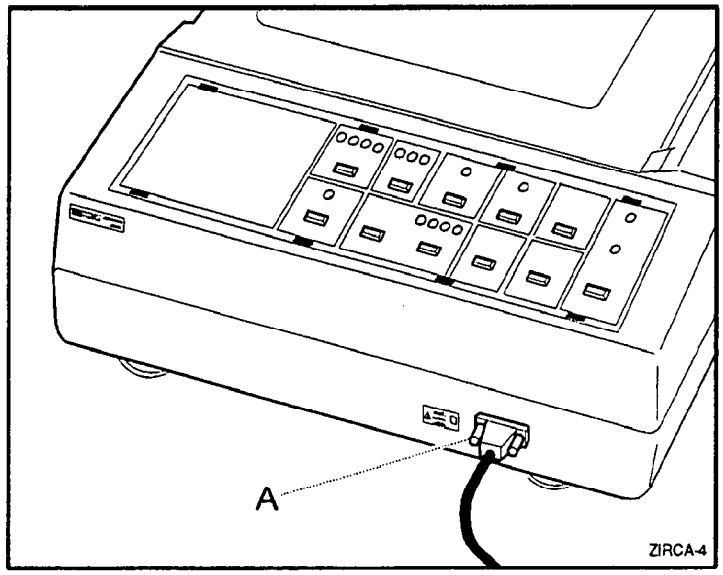


Figure A-5. Connecting the Patient Cable.

A. Patient Cable

Connect the Patient cable to the front of the cardiograph as shown in Figure A-5 and screw in both thumb-screws.

Loading Paper

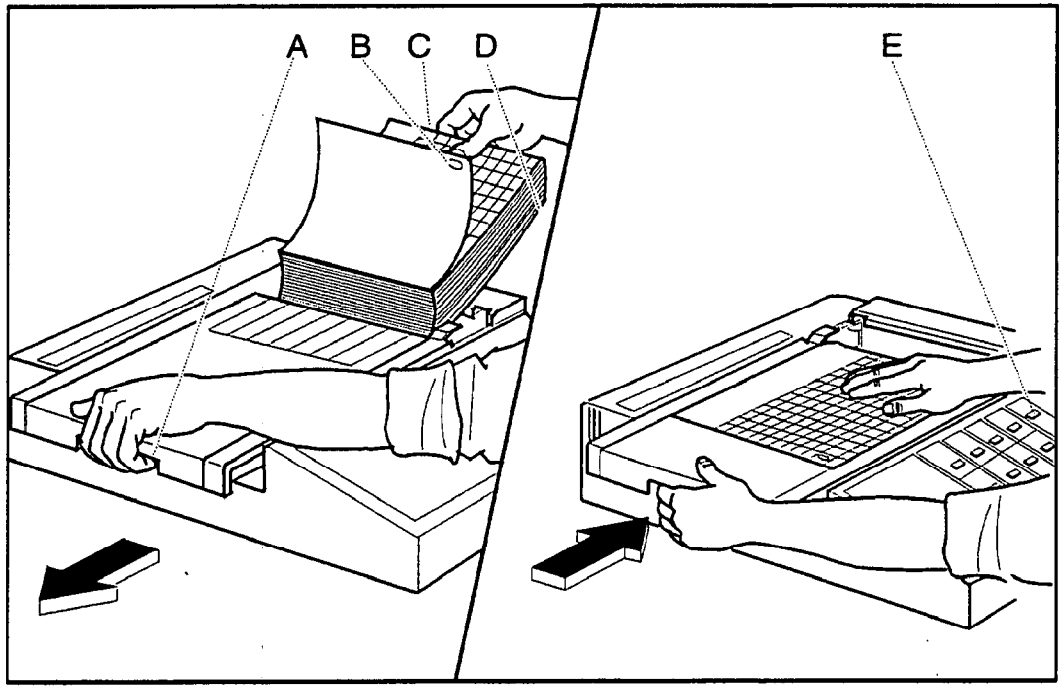


Figure A-6. Loading the Paper.

A. Paper Door Latch
B. Paper Sensing Hole
C. Paper
D. Cardboard Backing
E. [Page Advance] Key

The cardiograph uses continuous-feed Z-fold paper. For best results use Hewlett-Packard paper. See "Supplies" in Chapter 4 for ordering information.

To load the paper:

1. From the front of the cardiograph, release the latch on the left side and slide the paper door to your left.
2. Remove the outer packaging on the paper stack.
3. Place the paper stack in the compartment so that the top side of the paper feeds grid side up over the top panel. The paper sensing hole will be in the lower corner of the paper.
4. Pull a sheet halfway out and over the paper door. Make sure that the paper lays on the black roller evenly within the channel of the paper door. See Figure A-6.
5. Slide the paper door back into place. Make sure that the door is latched.
6. Press [On/Standby] to turn **On** the cardiograph, if necessary. Press [Page Advance] to advance the paper to the beginning of the next page.

Specifications

B

Specifications

Conforms to applicable IEC, UL, AAMI, CSA specifications.

Basic Controls

ECG Controls: On/Standby, Auto, Manual, Copy, Filter, Page Advance (paper feed), Stop.

ECG Format Controls: Chart Speed, ECG size, V Leads sensitivity. ECG Format Selections: Auto (3x4 with 1 rhythm lead); Manual (with 3 or 6 leads).

Frequency and Impulse Response

Sinusoidal: 0.67 to 40 Hz ±10%
Triangle: +0, -10%
Impulse (0.3 mV/sec)
Displacement: Less than 0.10 mV
Slope: Less than 0.30 mV/sec

Each meets or exceeds AAMI EC11-1991 standard for Diagnostic Electrocardiographic Devices.

Instrument Test

A self-test may be started by pressing and holding both the Auto and Manual keys while turning on the cardiograph with the On/Standby key. The instrument performs an internal self-test. The test results are printed on the report for use by service personnel. This self-test runs continuously until the cardiograph is turned to **Standby** (off).

Patient Safety

Patient Isolation: Less than 20 μA leakage with 120 VAC, 60 Hz or less than 50 μA leakage with 240 VAC, 50 Hz with patient cable.

Defibrillation Protection: Protected against damage from 400 joule defibrillator discharges.

Power and Environment

Line Power: 100 to 120 VAC, 50 to 60 Hz (at 115 VAC power-switch setting); 220 to 240 VAC, 50 to 60 Hz (at 230 VAC power-switch setting); 50 VA Maximum.

Fuse: 0.4 A for both the 115 and 230 VAC switch settings.

Environmental Operating Conditions: 10 to 40° C (50 to 104° F), 15 to 80% relative humidity, non-condensing, up to 4,550 m (15,000 ft.) altitude.

Environmental Storage Conditions: 0 to 50° C (32 to 122° F), 15 to 90% relative humidity, non-condensing, up to 4,550 m (15,000 ft.) altitude.

Cardiograph Dimensions: 43 by 39 by 10 cm (17.0 by 15.3 by 3.9 in.).

Cardiograph Weight: 8.5 kg (19.8 lbs.).

Glossary

Glossary

AC filter
A filter that screens out ECG artifact caused by power line interference. This filter is built into the cardiograph and cannot be disabled.

AHA leads
ECG lead names and identifying colors recommended by the American Heart Association. Limb leads are labelled RA, LA, LL, RL. Chest leads are labelled V1-V6. (See *IEC leads*)

alternating current (AC)
Electrical current provided by wall outlets. AC may be either 60 or 50 Hz depending on country.

artifact
ECG waveform distortion that may diminish ECG quality. ECG artifact (or noise) may be caused by electrical interference, poor electrode connections, or patient movement.

Auto ECG
Twelve-lead ECG recorded and analyzed over a ten second period and printed in a predetermined format. The PageWriter 100 prints Auto reports in a 3x4 format with one rhythm strip.

baseline wander
A slow upward or downward motion on the baseline of any ECG waveform.

baseline wander filter
Hewlett-Packard term for filter which reduces baseline wander.

battery saver
Hewlett-Packard term for the cardiograph turning to **Standby** automatically after a preset time period to conserve power. The battery saver is factory set for 30 minutes of cardiograph inactivity.

calibration pulse
A 200 ms, 1 mV square or stepped wave pulse which appears on the printed record. The calibration pulse shows the sensitivity at which the ECG was recorded.

cycle power
To press the [On-Standby] button to **Standby** (off) and then back to **On**.

ECG report
Paper copy produced by the cardiograph when the operator presses the [Auto] or [Manual] start key. This report includes a graphic representation of the heart's electrical activity (ECG waveforms) and identifying information.

front panel
Cardiograph area that includes the control keys.

Hertz (Hz)
A unit of frequency equal to one cycle per second.

IEC leads
Lead names and identifying colors recommended by the International Electrotechnical Commission standard. IEC limb electrodes are labelled R, L, F, and N. Chest electrodes are labelled C1-C6.

leads off
A trace consisting of a dotted line.

Manual ECG
ECG report format which runs continuously until the operator stops the recording. The ECG may show three or six lead waveforms. Some institutions and physicians may identify this format as a rhythm strip.

operator
The person who records the ECG.

patient cable
Hewlett-Packard term for the one-piece patient-lead set and instrument cable. The patient cable connects the cardiograph to the electrodes attached to the patient.

pre-acquisition
Hewlett-Packard term for acquiring 10 seconds of ECG prior to the operator pressing Auto.

rhythm strip
Hewlett-Packard term for ten-second recording of a particular lead that is printed at the bottom of an Auto ECG report. (See *Manual* and *Auto ECG*)

Standby mode
The cardiograph is off but the battery is kept charged while the unit is plugged into AC power.

standard leads
The conventional twelve lead order is I, II, III, aVR, aVL, aVF, V1 - V6.

Welsh cups
Reusable electrodes held in place with suction cups.

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